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Digital Health in KSA: The Influence of Demographics, Diagnoses and Consultation Dynamics on Patients' Satisfaction with Sehhaty Application

Ali. Abdulmana A Awadh¹, Yahia O Dhafar¹, Mona AlSubaie²,
Mohammed S. Aldossary³, Eman D. El Desouky⁴, Mohammed
Motaweh¹, Mona H. Elzohri^{1,5}

¹General Directorate of Medical Consultations, SEHA Virtual Hospital, Ministry of Health, Riyadh, Saudi Arabia;

²Seha Virtual Hospital, Ministry of Health, Riyadh, Saudi Arabia;

³General Directorate of Research and Studies, Ministry of Health, Riyadh, Saudi Arabia;

⁴Epidemiology and Biostatistics department, NCI, Cairo University, Cairo, Egypt;

⁵Department of Internal Medicine, Faculty of Medicine, Assiut University, Assiut, Egypt

aawwadh@moh.gov.sa; Yahia.Dhafar@hotmail.com; mssubaie@moh.gov.sa;

msaldossary@moh.gov.sa; eman.desouky@nci.cu.edu.eg; MMotaweh@moh.gov.sa;

melzohri@moh.gov.sa, mona.elzohri@aun.edu.eg.

Awadh ORCID ID: 0009-0004-4183-5693

Aldossary ORCID: 0000-0002-0380-7905

Desouky ORCID: 0000-0002-4517-4181

Elzohri ORCID ID: 0000-0003-3891-6519

Corresponding author: Mona H. Elzohri

Email: melzohri@moh.gov.sa, mona.elzohri@aun.edu.eg

ABSTRACT: Background: Optimizing service delivery with Sehhaty application requires an understanding of the relationship between demographic, consultation-related characteristics and patients' satisfaction.

Objectives: To evaluate current patients' satisfaction with Saudi Sehhaty application and correlation between satisfaction, demographic and consultation dynamics providing data-driven recommendations for service enhancement.

Methods: A retrospective cohort study analyzed 212,376 users of Sehhaty virtual clinics in Saudi Arabia from January 2023 to August 2024. Secondary data, demographics, ICD-10 diagnoses, and consultation dynamics, extracted from electronic medical records with post-consultation satisfaction surveys.

Results: High Patients' satisfaction 83.6%, app. usability receiving the highest rating. The most frequent clinical diagnoses were respiratory diseases (20.8%), primarily acute upper respiratory infections (70.3%), then general symptoms (15.0%) and health service counseling (11.8%). Regional analysis showed West and South contributed the highest consultation volumes (60.8%), while Central region reported highest satisfaction. Bivariate and multivariable analyses revealed younger age was the strongest independent predictor of satisfaction compared to the advanced elderly (OR=2.05, 95% CI: 1.68–2.51). Female gender was significantly associated with higher satisfaction (OR=1.20). Dissatisfied patients experienced 50% longer median waiting times. Multivariable modeling confirmed

increased waiting time (OR=0.93), longer talk time (OR=0.96), and a higher frequency of monthly calls (OR=0.86) were associated with lower odds of satisfaction ($p < 0.001$).

Conclusion: Sehhaty application serves as a highly effective digital front door for primary care in Saudi Arabia, particularly for acute respiratory conditions. High overall satisfaction, significantly driven by younger age and operational efficiency. Minimizing waiting times and call frequency is critical to maintaining patient contentment.

INTRODUCTION

Digital health is defined as the application of technology, including mobile devices, software, and sensors, to enhance health outcomes and the delivery of healthcare services (Ronquillo et al. 2022). Saudi Arabia has made considerable advancements in the integration of digital health where the journey commenced in the mid-1990s; where, a limited number of government hospitals undertook these initiatives (Ministry of National Guard Health Affairs E-services, 2023). According to the Kingdom of Saudi Arabia (2016), the Vision 2030 framework is a holistic initiative aimed at fostering economic and social advancement and initiation of the National Transformation Program (NTP). In this strategy, healthcare was designated as a primary focus, accompanied by a pledge to implement digital health technologies aimed at enhancing the delivery and outcomes of healthcare services.

The Ministry of Health (MOH) primarily oversees the healthcare system in Saudi Arabia, formulating the strategies and policies that direct health services across the nation (Sebai et al. 2001). The MOH recognizes healthcare as a fundamental right for the whole population, ensuring that all Saudi citizens and non-Saudis employed in the public sector receive free healthcare services (Mufti 2002). In March 2018, the Saudi MOH decided to extend its telemedicine services through introducing Sehha – App (Ministry of Health- Kingdom of Saudi Arabia, 2018). Sehha application is a mobile application launched for all Saudi citizens and non-Saudi residents at no cost and can be uploaded from either iOS or Android. Users are required to register in the app. using their mobile number. This app. offers tele medical consultations by means of videos, audios, and text messages, allowing patients to upload pictures or videos, e-prescription, and tele diagnosis by the MOHs' accredited doctors. The Sehha application can assist patients who speak in Arabic or English (Alanzi 2021; Alsyouf 2020; Hassounah et al.2020). The goal of MOH at that time is to cover the whole Kingdom by telehealth through this mobile-based telehealth service.

Sehha app. was replaced by Sehhaty platform in June 2021, to provide access to health information such as vital sign updates, tracking prescribed medicine, retrieving and sharing sick leave, and promoting a healthy lifestyle. It involves two main services, which are the Immediate Virtual Consultations (IVC) serviced by MOHs' physicians belonging to General Directorate of Medical Consultations (GDMC), and to other Saudi regional directorates where patient can immediately use voice call or video consultations and can send text message without waiting appointments. Virtual Clinics (VC) are the second service provided by Sehhaty app. that allows booking appointments and consultations at different specialties' clinics. Nevertheless, this particular app holds great promise for increasing access to care, reducing unnecessary readmissions, cutting health care costs; enhancing users' satisfaction and improving health care outcomes (Bradley et al. 2015; Minervini et al. 2022; Wang et al. 2022).

Patients typically express a high level of satisfaction with telemedicine services, (Mair and Whitten 2000; Vinade et al.2024) encompassing Saudi Arabia (Abdel Nasser et al. 2021; Abdulwahab and Zedan 2021; Albaghdadi and Al Daajani 2023; Alharbi et al. 2021; Alhumud et al. 2020; Alotaibi et al. 2023; AlShareef and AlWabel 2024 a,b; Alshareef et al.2021; Wafia et al.2022). Recent research indicated that more than one million virtual consultations were conducted in Saudi Arabia within an eighteen-month period (AlOmar et al.2024).

Comprehending the connection between patients' satisfaction and their demographic attributes, along with factors related to consultations, is crucial for enhancing the efficacy of digital health platforms. Research demonstrated that demographic factors, such as age, gender, and employment condition, significantly influence user experience and satisfaction with telehealth services, including those provided by Sehhaty. For example, a study revealed that individuals encountering technical challenges reported markedly lower satisfaction levels than those who did not face such problems. In addition, the overall satisfaction rate among Sehhaty users is 76.36%, indicating a favorable response to the app's usability and functionality. A significant proportion of users, continues to favor in-person consultations, indicating that demographic factors may play a role in shaping preferences for telehealth compared to traditional healthcare delivery methods (Dawood and Alkadi 2022).

The application's design and functionalities are specifically tailored to accommodate a wide range of user requirements, which can differ markedly among various demographic categories. For instance, female users may find particular health services incorporated within the app advantageous, and younger individuals may place a higher value on user- ease of use and accessibility (Alkhalifah et al.2022).

Several studies have shown that patients' age, gender, education level, income, and location play a role in determining satisfaction levels with telemedicine services. For instance, patients belonging to urban areas and those with higher education tend to report higher satisfaction rates compared to others (Kamimura et al.2012; Kee et al.2023; Mason et al. 2022; Susan et al.2000). Other studies showed female users and those with lower education levels was correlated with higher satisfaction rates with telemedicine services (Kamimura et al.2012; Mason et al. 2022; Susan et al.2000).

Consultation-related factors such as response time, quality of information provided, ease of communication, and perceived empathy of healthcare providers, also play a crucial role in shaping beneficiaries' satisfaction with Sehhaty application and should be investigated in further research. Prompt and accurate responses, personalized care, and effective communication have been identified as key factors influencing users' satisfaction with telemedicine and digital healthcare platforms (Kruse et al.2017; Pappot et al.2020). The relationship between these demographic characteristics and satisfaction scores highlights the importance of targeted improvements in the app's functionalities to meet the various segments of the population. Understanding the correlation between consultation-related factors and patients' satisfaction is essential for enhancing the service delivery and user experience with the Sehhaty application. While previous studies have, explored patients' satisfaction with digital healthcare applications, limited research has specifically examined the impact of demographic characteristics and consultation-related factors on patients' satisfaction with the Sehhaty application in the Kingdom of Saudi Arabia. Therefore, by examining these factors and their impact on beneficiaries' satisfaction, this study hopes to fill this gap in the literature.

2. OBJECTIVES

Aims of this study were:

- 1- To provide an update on the utility and current level of patients' satisfaction with the Sehhaty application in Saudi Arabia.
- 2- To identify the available beneficiaries' demographic characteristics such as Gender, Age, Residence and Nationality, and consultation-related dynamics as Waiting time, Talk time, Number of calls per month and the Reason for consultations or Complain together with their correlations with patients' satisfaction with Sehhaty application.
- 3- To provide insights and recommendations to enhance patients' satisfaction with the Sehhaty application, taking in consideration demographic characteristics and consultation-related factors.

3. MATERIALS AND METHODS

3.1. Study Material

A retrospective cohort study was conducted in Saudi Arabia in the period from January 2023 to August 2024. The study based on secondary data extracted from the electronic medical records of the Virtual Clinics platform of Saudi Arabia's Sehhaty app., along with data from a satisfaction questionnaire administered to users via the app. following their appointments. The post-appointment questionnaire distribution was a mandatory part of the study, although participation remained voluntary, allowing patients to respond either fully or partially.

3.2. Sample Collection

Customers of Sehhaty app. aged ≥ 18 years, both male and female, citizens and residents.

Data from 212,376 individuals (male and female) who utilized Sehhaty virtual clinics from January 2023 to August 2024.

3.3. Extraction Procedure

Extraction of data was conducted into Microsoft Excel. The confidentiality of participants was maintained by collecting data anonymously and handled in strict compliance with confidentiality protocols.

3.4. Analytical Methods

We conducted data quality checks, including reviewing, coding, and verifying the data, before performing statistical analyses using IBM SPSS Statistics (Version 27; Armonk, NY). The extracted variables were:

- **Demographic data:** Age, Gender, Nationality and Geographic location.

Participant age was analyzed according to the developmental analysis, ages were grouped into standard categories used in public health research: Infant/Toddler (1-4), Child (5-12), Adolescent (13-17), Young Adult (18-34), Middle Adult (35-54), Senior Adult (55-64), Elderly (65-74), and Advanced Elderly (75+). This framework, consistent with groupings used by the National Center for Health Statistics (2025), allows for the examination of health needs and technological accessibility tied to physiological and life phases (National Center for Health Statistics, 2025). The application of such demographic groupings to health behavior analysis is well supported in the literature, including regional studies profiling age-specific patterns (Alghamdi et al. 2025).

- **Consultation-related dynamics:** Waiting time, Duration of consultation, and Number of consultations per month.
- **Clinical characteristics:** Different diagnosis categories (coded using the ICD-10).
- **User experience metrics:** The user experience was evaluated through an eight -item instrument comprising three primary domains: application usability and technical performance (Q1, Q2), physician interaction quality (Q3–Q5), and service advocacy, which measured both the willingness to recommend the service and the perceived reduction in hospital visits (Q6–Q8). Each item utilized a 5-point Likert scale, ranging from 1 (Weak) to 5 (Excellent), and an overall satisfaction score was determined by

summing the individual responses. To improve clinical interpretability, satisfaction subscales were converted into binary variables. Following established health services research protocols for patient-reported outcomes (Austin and Brunner 2004; Terwee et al.2007). Patients were classified as “Satisfied” if they gave favorable feedback on 50% or more of the items within a domain, and “Not Satisfied” if they did so for less than half. This 50% threshold serves as an intuitive, straightforward benchmark for distinguishing between generally satisfied and unsatisfied users (Sitzia and Wood 1997)

To ensure internal consistency, Cronbach’s alpha was calculated, revealing excellent reliability for the total satisfaction score ($\alpha = .961$). The subscale reliabilities ranged from moderate to exceptional: application usability/technical performance (acceptable reliability, $\alpha = .632$), physician interaction quality (near-perfect reliability, $\alpha = .997$), and willingness to recommend/perceived reduction in visits (strong reliability, $\alpha = .875$).

3.5. Statistical analysis

Data of this study was entered into an Excel sheet for data cleaning and coding. Statistical analysis was performed using SPSS version 28.0 for Windows (IBM Corp., Armonk, NY, USA). Continuous data will be presented as mean (standard deviation). Categorical data will be summarized using numbers and percentages. The chi-square test to assess the association between satisfaction and categorical variables, while the student’s t-test and analysis of variance test, with post hoc analysis using the Tukey test, to evaluate this association with continuous variables. A multivariable logistic model to identify independent predictors of poor satisfaction. Odds ratio (OR) with a 95% CI to represent the degree of association between dependent and independent variables. A p -value of less than 0.05 was considered statistically significant.

4. RESULTS

1. Patients’ Demographics, Consultation Dynamics and Satisfaction Outcomes of the Study Cohort (Table 1)

The study cohort comprised 212,376 patients in the period from January 2023 to August 2024. The mean age was 27.9 years (SD ± 13.6), with a range from 1 to 99 years. The majority of patients were Young Adults (18-34 years; 55.3%). Females constituted 62.1% of the cohort. Nearly all patients were of Saudi nationality (95.5%), with representation from all regions of the country, mainly led by the South (30.1%) and West (29.1%) regions.

Consultation Dynamics indicated a median waiting time of 2.17 minutes (IQR 4.13) and a median physician talk time of 8.37 minutes (IQR 5.14). The median number of calls per patient per month was 1, with a maximum of 18.

Patients' satisfaction was high across measured domains. Application usability received the highest rating (86.8% satisfied), followed by overall satisfaction (83.6%), physician communication (81.5%), and likelihood to recommend the service (76.7%).

Table 1. Patients' Demographics, Consultation Dynamics and Satisfaction Outcomes of the Study Cohort (n=212,376).

		No.	%
Patients Age (yrs.)	Mean $\pm$ SD	27.9 $\pm$ 13.6	
	Range	1-99	
Patients Age Group	Infant/Toddler: 1-4	17,326	8.2
	Child: 5-12	15,369	7.2
	Adolescent: 13-17	3,568	1.7
	Young Adult: 18-34	117,468	55.3
	Middle Adult: 35-54	51,601	24.3
	Senior Adult: 55-64	4,629	2.2
	Elderly: 65-74	1,765	0.8
	Advanced Elderly: 75+	650	0.3
Gender	Female	131,975	62.1
	Male	80,401	37.9
Nationality	Saudi	202,791	95.5
	Resident	9,585	4.5
Region	South	63,935	30.1
	West	61,733	29.1
	North	41,370	19.5
	East	28,727	13.5
	Central	16,611	7.8
Waiting time(minutes)	Median (IQR)	2.17(4.13)	
Talk time(minutes)	Median (IQR)	8.37(5.14)	
No. of calls /month	Median (Range)	1(1-18)	
Satisfaction Dimensions	App. usability	184,428	86.8
	Physician's communication	173,024	81.5
	Likelihood of recommendations	162,986	76.7
	Overall	177,459	83.6

SD: standard deviation, IQR: interquartile range

2. Clinical characteristics of the Study Cohort (Table 2)

The clinical indications for telehealth consultations were categorized using ICD-10 chapters. Diseases of the respiratory system were the most frequent reason for contact, accounting for 20.8% (n=28,075) of all diagnoses. Within this category, acute upper respiratory conditions like nasopharyngitis (common cold), pharyngitis, and tonsillitis were predominant (70.3% of respiratory diagnoses). The second most common category was 'Symptoms, signs, and abnormal clinical findings' (15.0%, n=20,233), with cough, headache, and unspecified pain being the leading complaints. This was followed by contacts for health services (e.g., counseling and examinations) at 11.8% (n=15,870).

Diseases of the digestive system (8.0%, n=10,755) and diseases of the skin and subcutaneous tissue (7.9%, n=10,649) were also prevalent. Irritable bowel syndrome and constipation led digestive complaints, while acne and dermatitis were the most common skin conditions. Certain infectious and parasitic diseases represented 6.0% (n=8,119) of contacts, primarily candidiasis and gastroenteritis.

Table 2. Top Five Clinical Presentations per Major Diagnostic Category (n=135,045).

		No.	%
I	Diseases of the respiratory system (J00-J99)	28,075	20.8*
1	Acute nasopharyngitis [common cold]	11,383	40.5
2	Acute pharyngitis	3,143	11.2
3	Acute tonsillitis	2,688	9.6
4	Acute upper respiratory infection, unspecified	2,515	9
5	Asthma	1,153	4.1
II	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	20,233	15.0*
1	Cough	3884	19.2
2	Headache	1481	7.3
3	Pain, unspecified	1390	6.9
4	Fever, unspecified	1182	5.9
5	Rash and other nonspecific skin eruption	1178	5.8
III	Factors influencing health status and contact with health services (Z00-Z99)	15,870	11.8*
1	Counseling, unspecified	4,621	29.2
2	General medical examination	2,474	15.6
3	Other specified counselling	1,269	8
4	Other medical care	1,119	7.1
5	Person consulting for explanation of investigation findings	841	5.3
IV	Diseases of the digestive system (K00-K93)	10,755	8.0*
1	Irritable bowel syndrome	1,545	14.4
2	Constipation	1,374	12.8
3	Gastro-oesophageal reflux disease	977	9.1
4	Dental caries	890	8.3
5	Gastritis and duodenitis	802	7.5
V	Diseases of the skin and subcutaneous tissue (L00-L99)	10,649	7.9*
1	Acne	1,168	11
2	Atopic dermatitis	1,148	10.8
3	Dermatitis, unspecified	1,098	10.4
4	Allergic contact dermatitis	889	8.4

5	Diaper [napkin] dermatitis	643	6.1
VI	Certain infectious and parasitic diseases (A00-B99)	8,119	6.0*
1	Candidiasis	1,148	14.3
2	Gastroenteritis and colitis of unspecified origin	1,141	14.2
3	Viral conjunctivitis	541	6.7
4	Candidiasis of vulva and vagina	338	4.2
5	Other gastroenteritis and colitis of infectious and unspecified origin	314	3.9

*Percent from total number (n=135,045)

3. Regional Characteristics of the Study Cohort (Table 3)

Consultations were distributed across all regions, with the West (32.0%, n=43,162) and South (28.8%, n=38,895) regions contributing the highest volume, together accounting for 60.8% of all regionally analyzed diagnoses. The Central region accounted for the smallest proportion (8.8%, n=11,949). The ranking of the top five diagnostic categories was largely consistent nationwide. Diseases of the respiratory system was the leading category in four of five regions (Central, North, South, West) and ranked second in the East region. Symptoms, signs, and abnormal findings was consistently the second most common category, while contacts for Factors influencing health status (e.g., counseling) ranked third in most regions.

A notable variation was observed in the East region, where Factors influencing health status and contact with health services was the most frequent diagnostic chapter (20.1%), representing a higher proportion than in any other region.

Table 3. Top Five Clinical Presentations per region (n=135,045).

	No.	%
Central	11,949	8.8*
1 Diseases of the respiratory system	2,309	19.3
2 Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	2,025	16.9
3 Factors influencing health status and contact with health services	1,654	13.8
4 Diseases of the digestive system	895	7.5
5 Diseases of the skin and subcutaneous tissue	848	7.1
East	19,368	14.3*
1 Factors influencing health status and contact with health services	3,887	20.1
2 Diseases of the respiratory system	3,603	18.6
3 Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	2,948	15.2
4 Diseases of the skin and subcutaneous tissue	1,472	7.6
5 Diseases of the digestive system	1,264	6.5
North	21,671	16.1*
1 Diseases of the respiratory system	4,411	20.4
2 Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	2,972	13.7
3 Factors influencing health status and contact with health services	2,156	9.9
4 Diseases of the skin and subcutaneous tissue	1,893	8.7
5 Diseases of the digestive system	1,668	7.7

South		38,895	28.8*
1	Diseases of the respiratory system	8,634	22.2
2	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	5,825	15.0
3	Factors influencing health status and contact with health services	4,457	11.5
4	Diseases of the digestive system	3,417	8.8
5	Diseases of the skin and subcutaneous tissue	3,019	7.8
West		43,162	32.0
1	Diseases of the respiratory system	9,118	21.1
2	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	6,463	15.0
3	Factors influencing health status and contact with health services	3,716	8.6
4	Diseases of the digestive system	3,511	8.1
5	Diseases of the skin and subcutaneous tissue	3,417	7.9

*Percent from total number (n=135,045)

4. Association between Patients' Demographics, Consultation Dynamics, and Overall Satisfaction (Table 4)

Overall satisfaction was 83.6% (n=177,459). Bivariate analyses revealed statistically significant differences ($p < 0.001$) across all examined subgroups. Satisfaction was slightly higher among females (84.1%) compared to males (82.6%), and among Saudi nationals (83.6%) compared to residents (82.2%). A clear gradient was observed across age groups: satisfaction was highest in the youngest cohorts (e.g., 89.5% in infants/toddlers) and progressively declined with advancing age, reaching 79.2% in the advanced elderly (75+ years). Regional variation in satisfaction was modest, ranging from 85.6% in the Central region to 82.9% in the East."

Consultation dynamics differed significantly between satisfied and dissatisfied patients. Dissatisfied patients experienced a 50% longer median waiting time (3 minutes, IQR 1-7) compared to satisfied patients (2 minutes, IQR 1-4). Consultations for dissatisfied patients were also longer (median talk time: 10 vs. 8 minutes) and were associated with a higher mean number of calls per month (1.8 ± 1.3 vs. 1.6 ± 1.1).

Table 4. Association between Patients' Demographics, Consultation Dynamics, and Overall Satisfaction.

		Overall		
		Not Satisfied	Satisfied	
	N total	n=34,917(%)	n=177,459(%)	P value
Gender				
Female	131,975	20960(15.9)	111015(84.1)	<0.001
Male	80,401	13957(17.4)	66444(82.6)	
Nationality				
Resident	9,585	1702(17.8)	7883(82.2)	<0.001
Saudi	202,791	33215(16.4)	169576(83.6)	
Age Group				
Infant/Toddler: 1-4	17,326	1819(10.5)	15507(89.5)	<0.001

Child: 5-12	15,369	1736(11.3)	13633(88.7)	
Adolescent: 13-17	3,568	464(13.0)	3104(87.0)	
Young Adult: 18-34	117,468	21074(17.9)	96394(82.1)	
Middle Adult: 35-54	51,601	8465(16.4)	43136(83.6)	
Senior Adult: 55-64	4,629	874(18.9)	3755(81.1)	
Elderly: 65-74	1,765	350(19.8)	1415(80.2)	
Advanced Elderly: 75+	650	135(20.8)	515(79.2)	
Region				
Central	16,611	2385(14.4)	14226(85.6)	<0.001
East	28,727	4914(17.1)	23813(82.9)	
North	41,370	6883(16.6)	34487(83.4)	
South	63,935	10310(16.1)	53625(83.9)	
West	61,733	10425(16.9)	51308(83.1)	
Waiting Time (minutes)	Median (IQR)	3(1-7)	2(1-4)	<0.001
Talk time(minutes)	Median (IQR)	10(7-14)	8(5-11)	<0.001
No. of calls /month	Mean (SD)	1.8(1.3)	1.6(1.1)	<0.001

5. Multivariable logistic regression analysis for different Patients' satisfaction dimensions (Table 5)

Table 5 presents the adjusted odds ratios from multivariable logistic regression models for four satisfaction dimensions. After controlling for all other variables, younger age remained the strongest independent predictor of higher satisfaction. Compared to the advanced elderly (75+), infants/toddlers had more than double the odds of being satisfied with usability (OR=1.98, 95% CI: 1.59-2.46) and overall service (OR=2.05, 95% CI: 1.68-2.51). Female gender was consistently associated with greater satisfaction across all domains (e.g., Overall OR=1.20, 95% CI: 1.17-1.23). Regarding consultation dynamics, longer waiting time (Overall OR=0.93 per minute, 95% CI: 0.93-0.93), longer talk time (Overall OR=0.96 per minute, 95% CI: 0.96-0.96), and a higher number of calls per month (Overall OR=0.86 per call, 95% CI: 0.85-0.87) were all independently associated with significantly lower odds of satisfaction.

The association of region with satisfaction varied by domain. For example, residence in the Central region was associated with higher odds of satisfaction for all domains, while residence in the East, North, or South was associated with lower odds for physician communication, recommendation, and overall satisfaction compared to the West. The strength of the association between younger age and satisfaction was most pronounced for Usability and Overall satisfaction.

Table 5. Multivariable Logistic Regression of Factors Associated with Different Dimensions of Patients' Satisfaction.

	Usability	Physician	Recommendation	Overall
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Age group				
Infant/Toddler: 1-4	1.978(1.593-2.457)	1.738(1.425-2.12)	1.788(1.493-2.142)	2.053(1.679-2.511)

Child: 5-12	1.915(1.541-2.379)	1.684(1.38-2.055)	1.788(1.492-2.143)	1.938(1.584-2.37)
Adolescent: 13-17	1.729(1.364-2.191)	1.501(1.21-1.861)	1.623(1.335-1.974)	1.666(1.339-2.074)
Young Adult: 18-34	1.259(1.02-1.554)	1.061(0.874-1.287)	1.145(0.96-1.366)	1.223(1.005-1.487)
Middle Adult: 35-54	1.402(1.135-1.732)	1.239(1.02-1.505)	1.332(1.116-1.59)	1.381(1.134-1.681)
Senior Adult: 55-64	1.168(0.932-1.463)	1.099(0.894-1.352)	1.204(0.997-1.454)	1.161(0.942-1.431)
Elderly: 65-74	1.064(0.831-1.361)	1.041(0.83-1.305)	1.109(0.902-1.363)	1.085(0.862-1.364)
Advanced Elderly: 75+	Ref.	Ref.	Ref.	Ref.
Gender (Female/Male)	1.248(1.215-1.282)	1.137(1.111-1.164)	1.118(1.094-1.143)	1.197(1.168-1.227)
Nationality	1.064(1.001-1.131)	1.035(1.018-1.092)	1.137(1.083-1.194)	1.074(1.016-1.136)
Region				
Central	1.137(1.077-1.199)	1.109(1.058-1.163)	1.099(1.053-1.147)	1.132(1.077-1.189)
East	0.978(0.938-1.019)	0.933(0.899-0.968)	0.908(0.878-0.939)	0.949(0.913-0.986)
North	0.971(0.935-1.009)	0.853(0.826-0.882)	0.815(0.791-0.84)	0.902(0.871-0.933)
South	0.954(0.923-0.987)	0.878(0.852-0.904)	0.884(0.86-0.908)	0.912(0.884-0.94)
West	Ref.	Ref.	Ref.	Ref.
Average talk time	0.964(0.962-0.966)	0.965(0.963-0.967)	0.967(0.966-0.969)	0.962(0.96-0.964)
Waiting time	0.932(0.93-0.934)	0.936(0.934-0.937)	0.939(0.938-0.941)	0.931(0.93-0.933)
No of calls/month	0.855(0.847-0.864)	0.863(0.855-0.87)	0.9(0.892-0.907)	0.859(0.851-0.867)
Constant	18.496	6.211	5.164	9.588

OR: odds ratio, CI: Confidence interval

5. DISCUSSION

The findings from our extensive study of 212,376 patients demonstrates the successful implementation of a national telehealth service and offer valuable insights into the demographic profiles and satisfaction levels linked to the Sehhaty application in the Kingdom of Saudi Arabia (KSA). The data provided reflects the successful integration of digital health services within the KSA, particularly in alignment with the goals of Saudi Vision 2030. Based on this, a previous study of the general Saudi population revealed that more than half of the respondents had utilized e-consultations, identifying it as one of the most prevalent digital health services. Complementary research indicated that approximately half of the population engaged with the application's health check services in KSA, further illustrating high utilization rates across the general public (Aldhahir et al.2022; Alharbi et al. 2021; Muzafar and Jhanjhi 2020).

Our participants' mean age was 27.9 years, with a standard deviation of ± 13.6 years, indicating a predominantly young population. Notably, 55.3% of the patients fell within the young adult category (ages 18-34), which reflects the increasing engagement of this demographic in utilizing digital health platforms. This tilt may reflect the increased use of digital health or specific healthcare needs within these groups and should be considered for targeted service development and marketing. Global observations showed that younger populations were increasingly turning to digital health platforms for medical consultations and health management (Lupton 2021). The notable gender distribution, with females constituting 62.1% of this cohort, raises important considerations for healthcare providers and policymakers. Previous research indicates that women were generally more proactive in seeking healthcare services and utilizing digital tools for health management (Almalki et al.2023). This heightened engagement among females may reflect broader societal trends towards increased health awareness and the pursuit of accessible healthcare options. In a similar circumstance, a study conducted in the Western region of Saudi Arabia to assess

telemedicine acceptability among patients at primary health care clinics, the median age was 40 years old, with an interquartile range of 30 to 52. The majority of participants were females (61.1%) (Alzahrani et al. 2023). In another nationwide cross-sectional study assessing patient opinions on virtual consultations in Saudi Arabia, it was found that among the 916 participants, 53.7% were female, with an average age of 47.2 years (SD $\pm$ 14.1) (AlShareef and AlWabel 2024a).

Similarly, a KSA study done to evaluate the e-health (Seha) application, approximately 60.8% of the sample was females, and most of the participants were within the 30–49 age group (61.9%) (Alharbi et al. 2021). In contrast to digital consultation trends, a study conducted in Southwestern Saudi Arabia assessing the impact of e-health on patient satisfaction in primary healthcare centers revealed that 53% of on-site participants were male (Asiri et al. 2024). This gender distribution may be attributed to higher levels of physical mobility among males, whereas females often demonstrate a stronger preference for the privacy and convenience afforded by virtual consultations. Globally a study conducted to detect the patient characteristics associated with telemedicine access for primary and specialty ambulatory care during the COVID-19 pandemic where a total of 148,402 unique patients with 58 % women, mean [SD] age, 56.5% [17.7]

years) had scheduled telemedicine visits during the study period and interestingly female sex was associated with more telemedicine visits (aOR, 1.04 [95%CI, 1.02-1.06]). Asian race (aOR, 0.69 [95%CI, 0.66-0.73]) was associated with fewer completed telemedicine visits (Eberly et al. 2021).

The majority of our participants (95.5%) were Saudi nationals, with notable regional engagement from the South (30.1%) and West (29.1%), illustrating the platform's broad geographic reach. This high adoption is largely attributed to the app's integration with the National Information Center (Absher), which establishes it as a unified national health record and a vital gateway for prescriptions and long-term care management. Currently, as a cornerstone of the Saudi National Healthcare Transformation Program, the Sehhaty app serves over 30 million users. It provides access to more than 40 digital services, including virtual consultations, pharmacy locators, and vital sign monitoring. By digitizing these interactions, the platform serves as a leading model for the Kingdom's digital strategy (Eye of Riyadh 2024). The geographic distribution of users aligns roughly with population densities, confirming broad national penetration. In a previous slightly similar Saudi study measuring the patients' satisfaction about telemedicine during COVID-19 pandemic where the authors found 36.9% of the study participants had an age ranged from 18 to 25 years, 63.1% were females, and 76.6% had a Saudi nationality (Abdel Nasser et al. 2021).

This demographic profile is pivotal for elucidating the determinants of patient satisfaction and engagement with Sehhaty-mediated medical consultations. The high volume of utilization in the Western and Southern regions underscores the platform's role in mitigating geographic and infrastructural barriers outside the capital. Specifically, the West region (including Jeddah and Makkah) leverages superior digital literacy and the integrated Health Cluster model to prioritize digital-first pathways for non-emergency diagnoses. Ironically, a study conducted in Jeddah, in the West of Saudi Arabia, found that positive telemedicine impressions were highly satisfactory. The majority of participants expressed their desire to participate in future telemedicine consultations and stated that telehealth services have improved accessibility (Fisk et al.2020). In contrast with earlier literature, previous studies identified the Western provinces as having the lowest utilization rates of the Seha application (Alharbi et al. 2021), despite having relatively high e-service availability (Noor 2019). At that time, the discrepancy was attributed to low community awareness and a cultural preference for face-to-face consultations, particularly in rural areas (Al-rayes et al. 2020; Alruzaiza and Mahrous 2020; Alshammari 2019).

While earlier studies were limited by selection bias or smaller sample sizes (Althumairi et al.2022), the current data indicates that the Western region has now successfully leveraged its infrastructure to become a primary driver of national telehealth engagement. Historically, in the South (e.g., Asir and Jazan), the platform addresses healthcare access challenges posed by mountainous terrain and substantial travel burdens. Consistent with existing literature, telemedicine adoption is positively correlated with geographic isolation; beneficiaries in these locales circumvent arduous commutes to primary healthcare centers (PHCs) through virtual consultations. This is empirically supported by research in Southwestern Saudi Arabia, where Sehhaty emerged as the most utilized (88.8%) and preferred (73.5%) e-health application, demonstrating that the systematic implementation of electronic health services within regional PHCs significantly enhances patient satisfaction (Asiri et al. 2024).

In a previously nationwide study conducted to compare the convenience, quality of interaction, and satisfaction of virtual and in-person healthcare consultations in Saudi Arabia concluded participants attending virtual consultations were more likely to live rurally (69.0% vs. 21.9% for in-person consultations; $p < 0.001$) (AlShareef and AlWabel 2024b). Notably, Alghamdi et al.

(2021) demonstrated that the adoption of digital health platforms is mediated by variables such as digital literacy, perceived privacy, and system architecture.

The finding that the Central region which home to the capital, Riyadh contributed the smallest proportion of consultations (8.8%) is counterintuitive given its high population and technology penetration. This may be explained by service saturation. Accessibility of physical care where residents in the Central region have the highest density of specialized hospitals and private clinics in the Kingdom. Research suggest that when physical healthcare is highly accessible and within short driving distances, beneficiaries may still prefer in-person visits over virtual ones for specific diagnoses. Some studies have noted that large tertiary hospitals in Riyadh often use their own proprietary of patient portals for follow-ups, which might divert consultation volume away from the unified Sehhaty platform in this region (Alharbi and Rakyan 2025).

Also, Althubaiti et al.(2022) contend, achieving comprehensive digital health transformation necessitates the upskilling of healthcare providers to ensure they effectively utilize and advocate for platforms like Sehhaty. When we analyzed operational metrics, we hypothesized that the resulting low median waiting time (2.17 minutes) suggests efficient triage and queue management, a critical factor for user retention in telehealth. The median talk time was approximately 8 minutes consistent with typical consultation lengths for remote, non-emergent care. Also, the finding that the median number of calls per month is 1 indicates that for most users, the service addressed their immediate need without requiring frequent follow-up within the same month, hinting at potential effectiveness or resolution. In concordance, a multicenter study investigating telemedicine utilization in Saudi Arabia during COVID-19 pandemic reported highly responsive service delivery, with a mean ($\pm$ SD) waiting time of 2.54 ($\pm$ 6.8) minutes indicating that the majority of participants experienced near-instantaneous connectivity. In addition, they showed telephonic consultations exhibited a median duration of 5 minutes reflecting a concise yet variable interaction timeframe between physicians and beneficiaries (Al Mutair et al. 2023).

Clinical utilization of our telehealth service was primarily driven by acute, primary care concerns. Categorization via ICD-10 chapters revealed that respiratory system disease constituted over one-fifth of all diagnoses, with acute upper respiratory conditions such as nasopharyngitis (common cold), pharyngitis and tonsillitis being the most frequent (70.3%) of respiratory diagnoses. Aligns with telehealth's utility in triaging common illnesses and providing initial guidance, potentially reducing unnecessary in-person visits. This was followed by non-specific symptomatic presentations mainly cough, headache, and unspecified pain (15%). Followed by a significant proportion of contacts classified under Factors influencing health status (11.8%), primarily for counseling and examinations, this highlights an important secondary function of Sehhaty app. in facilitating preventive care and administrative health services. Interestingly, digestive system (8 %) and dermatological issues (7.9%), irritable bowel syndrome, constipation, acne and dermatitis showed significant prevalence, suggesting that users view the platform as a viable tool for both acute episodes and the management of ongoing symptomatic complaints. Infectious and parasitic diseases accounted for 6 % of the total consultations volume primarily candidiasis and gastroenteritis. These findings establish a clear imperative for refining clinical protocols and enhancing specialist integration within the telehealth framework. Also, the diagnostic distribution denoted that this national telehealth service primarily functions as an accessible first point of contact for common acute illnesses, chronic condition management, and preventive health counseling.

Consistent with the present findings, a prior investigation into Saudi telemedicine trends during the COVID-19 pandemic reported that family medicine accounted for the highest volume of consultations, whereas infectious disease inquiries represented the smallest proportion of calls (Al Mutair et al. 2023). Also, AlShareef and Alwabel study demonstrated virtual consultations in Saudi Arabia were significantly more common for primary care and diabetes/endocrinology compared to surgical specialties (AlShareef and AlWabel 2024b). Diseases of the respiratory system was also the primary reason for contact in the four Saudi regions (West, South, Central and North), followed by symptomatic findings and health counseling. A distinct variation occurred in the East region, where Factors influencing health status and health services emerged as the leading category (20.1%). This unique profile of the East region warrants further qualitative investigation to understand the drivers behind its higher rate of counseling and health service contacts, as this model may offer insights for enhancing preventive care delivery via telehealth. This geographic disparity may be attributed to fluctuations in population density, digital literacy, and local promotional efforts.

High patients' satisfaction rates, ($>83\%$ overall) in this study, was driven by different satisfaction domains, highest for app. usability (86.8%) and lowest for likelihood to recommend (76.7%). Furthermore, physician communication was positively rated by 81.5% of respondents. These results provide a clear roadmap for quality improvement focused on enhancing patient advocacy and the perceived value of the service that aligns with international benchmarks while addressing specific local needs

under the Saudi Vision 2030 framework. Comparing previous Sehhaty satisfaction, Al Mutair et al. study rated overall telemedicine Saudi services satisfaction of 88.82% (Al Mutair et al. 2023). One study demonstrated a 76% general satisfaction rate among users of Sehhaty application, signifying substantial platform acceptance [63]. In another previous research, over 80% of participants reported being satisfied or very satisfied with the quality of care and their experiences with telemedicine, both in primary care (Abdel Nasser et al.2021; Abdulwahab and Zedan 2021; Alharbi et al.2021; Alotaibi et al.2023; Dawood and Alkadi 2022) and specialized medical contexts (Abdulwahab and Zedan 2021; Alghamdi et al. 2021; Alharbi and Rakyan 2025; Alharbi et al. 2021; Alhumud et al. 2020; Al Mutair et al. 2023; Al-rayes et al. 2020; Alruzaiza and Mahrous 2020; Alshammari 2019; Alshareef et al.2021; Althubaiti et al.2022; Althumairi et al.2022;Dawood and Alkadi 2022; Fisk et al.2020; Hassounah et al.2020; Noor 2019; Wafia et al.2022).

Patients' satisfaction demonstrated notable demographic and operational trends. While female and Saudi national cohorts reported slightly higher approval ratings (83.6% and 84.1% respectively), a significant inverse relationship was observed between age and satisfaction; the highest ratings were concentrated in the youngest pediatric cohorts (89.5%), with a steady decline (79.2%) noted as age increased toward the advanced elderly. While statistically significant due to the large sample size, the absolute differences in satisfaction across gender and nationality were small, suggesting these were not major determinants of the patient experience but may reflect a strong cultural alignment with telehealth services. In Saudi Arabia, female users often demonstrate higher adoption rates and positive attitudes toward telemedicine. This is frequently attributed to the convenience factor. Historically, logistical challenges such as transportation and the need for a male guardian or driver for clinical visits created barriers for women. Telemedicine bypasses these hurdles. The authors argued that the privacy and autonomy provided by apps like *Sehhaty* and *Seha* align well with cultural preferences for home-based care. In addition, according to a previous Saudi study, digital health literacy and platform engagement were particularly pronounced among younger adult females (Alhur et al.2023). A prior study conducted in Saudi Arabia found that female gender, high levels of satisfaction and comprehension of telehealth, and the quality of care obtained were predictors of embracing telemedicine (Polinski et al.2016).

A non-significant difference was found between satisfaction scores and the participants' gender, supported by Neter and Brainin study who observed individual demographic characteristics significantly shape the patterns and behaviors associated with online health information-seeking (eHealth literacy 2012). The strong, inverse relationship between age and satisfaction is a critical finding in this study. Which may reflect technological comfort, higher expectations, or more complex health needs among older adults that are less fully addressed in a standard telehealth consultation. Similarly, Abdel Nasser et al. study found the participants' satisfaction and attitude towards telemedicine was significantly higher in the age group ranging from 18 to 25 years old compared to other participants, attributed this as younger age had more familiarity with the use of technology (Abdel Nasser et al.2021).

Geographically, satisfaction remained relatively consistent, with only a marginal variance between the Central (85.6%) and Eastern (82.9%) regions. These findings align with prior research highlighting geographic disparities in Saudi Arabia, where telemedicine utilization concentrated in urban areas. This concentration underscores the critical necessity of ensuring equitable access for underserved rural populations [48]. Furthermore, localized evidence from Riyadh suggests that urban residents maintain high satisfaction levels with integrated virtual consultations, even when encountering technical interruptions, indicating a high degree of resilience and acceptance among urban users (AlShareef and AlWabel 2024a).

In line with localized evidence from Al-Dammam, HCPs in the East region of KSA exhibit high telemedicine literacy and a proactive interest in digital service delivery, influenced largely by their familiarity and positive prior experiences with the technology (Alajmi et al. 2015).

Crucially, consultation dynamics emerged as a primary driver of satisfaction; dissatisfied users faced a 50% increase in median waiting times and longer consultation durations compared to their satisfied counterparts. It is worth noting that while longer talk times in face-to-face medicine are often seen as better care, in a digital context, they can actually signal technical difficulties, a lack of clinical clarity, or inefficient communication. Furthermore, higher call frequency was associated with lower satisfaction, suggesting that clinical complexity or unresolved issues may negatively impact user experience. In alignment with existing literature, teleconsultations have been found to require significantly less time than traditional in-person visits. This increased efficiency facilitates higher patient throughput, which is an essential requirement for expanding access and meeting the high-volume demands of primary healthcare systems (Pogorzelska et al. 2023). The regression model provided a comprehensive framework for understanding Sehhaty platform satisfaction by identifying two critical strategic pillars. First, it emphasizes the

need for demographic adaptation through age-inclusive interfaces and enhanced support for geriatric users. Second, it highlights operational excellence, specifically the rigorous management of waiting time and the optimization of consultation workflows. By targeting these independent predictors, healthcare providers can systematically address the primary drivers of both satisfaction and dissatisfaction within this national cohort.

6. CONCLUSION

The Sehhaty application has become a cornerstone of Saudi Arabia's digital health transformation efficiently addressing primary care particularly for young adults and respiratory conditions. The platform shows itself to be a workable and well-received model for national healthcare delivery, with a high overall satisfaction rate and an exceptionally short median waiting time. The platform effectively serves as a digital front door, triaging and managing common acute conditions that may otherwise clog traditional emergency departments, as evidenced by the prevalence of respiratory disorders. The most important indicator of satisfaction is younger age, while Saudi nationals and women routinely report higher levels of contentment. Although the Central region reports the best satisfaction odds, the West and South generate the highest consultations volume, indicating a need for customized service improvement in other regions.

7. RECOMMENDATIONS

To guarantee standardized care, create telehealth-specific standards for the most prevalent illnesses (respiratory and dermatological). Being the strongest operational indicator of discontent, waiting time should be optimized to a median less than three minutes. Standardize regional quality to maximize service delivery in less served regions. Improve the Sehhaty app's referral processes to enable a smooth transition from general triaging to specialized assistance, such as for chronic digestive and skin issues.

8. LIMITATIONS

Limited Clinical Outcomes: The study mainly focused on patients, demographics, consultation dynamics (waiting time, talk time), and perceived satisfaction. Demographic imbalance (Selection Bias): It does not include data on other demographics, and follow-up success rates. Digital Literacy and Access: This may be affected by unmeasured variables like digital literacy levels or challenges in using the mobile interface, rather than the quality of the consultation itself. Operational Confounding: Although longer talk times were linked to lower satisfaction, the study does not consider the complexity of the cases. Nature of Self-Reporting: Satisfaction data comes from post-consultation surveys, which may experience non-response bias. Patients with neutral feelings might be less likely to respond than those who were either very happy or frustrated. Regional Data Disparity: While geographic location is an important factor in telehealth adoption, the current study could not find a clear correlation. This limitation results from uneven participant distribution and a small sample size in certain regions, which increased the risk of selection bias.

9. DECLARATIONS

9.1. Statement of Ethics

This study was performed in accordance with the Declaration of Helsinki. The Central Institutional Review board and Data management office at the Saudi MOH was approved the research proposal and the data collection tool of the current study with an IRB log number: IRB log No: 24-76M. Protection of privacy and confidentiality: The data of the patients will be presented anonymously with protection of privacy and confidentiality. Publication policy: Any active participant involved in this work will be included in any publications.

9.2. Conflicts of Interest Statement

All authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

9.3. Funding Sources

All authors have declared that no financial support was received from any organization for the submitted work. They have declared that they have no financial relationships with any organizations that might have an interest in the submitted work.

9.4. Author Contributions

All authors approve the final version for publication. They also acknowledge their responsibility for all aspects of the work, ensuring that any inquiries regarding the accuracy or integrity of any component of the study are thoroughly examined and addressed. Conception, design and revision: Ali. Abdulmana A Awadh; Manuscript revision: Yahia O Dhafar and Mona AlSubaie; Data analysis, Methods draft, and results interpretation: Eman D. El Desouky; Critical Revision and feedback with final proofreading: Mohammed Aldossary; Collection and cleaning of data: Mohammed Motaweh; Writing Manuscript and correspondence of IRB and publication: Mona H. Elzohri.

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9.6. Data Availability Statement

All data used in this study are available within the article itself. Further inquiries can be directed to the corresponding author.

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